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## 14. GLOSSARY

(Note: A number of the terms in the Glossary emphasize their project-specific relationship to the Yucca Mountain Repository EIS. Words in *italics* refer to other words in the glossary.)

### 100-year flood

A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1-percent chance of its occurring in a given year.

### 500-year flood

A flood event of such magnitude that it occurs, on average, every 500 years; this equates to a 0.2-percent chance of its occurring in a given year.

### A-weighted decibel scale

See *decibel, A-weighted*.

### accessible environment

(1) The atmosphere, land surfaces, and surface waters beyond a *controlled area* that humans or animals can contact. (2) The area surrounding a *nuclear waste* disposal site.

### accident

An unplanned sequence of events that results in undesirable consequences. Examples in this EIS include an inadvertent release of *radioactive* or hazardous materials from their containers or *confinement* to the *environment*; vehicular accidents during the transportation of highly radioactive materials; and industrial accidents that could affect workers in the facilities.

### acre-foot

The volume of water required to cover 1 acre to a depth of 1 foot (about 1,200 cubic meters or 330,000 gallons).

### actinide

Any of a series of chemically similar, mostly synthetic, *radioactive* elements with *atomic numbers* ranging from actinium-89 through lawrencium-103.

### active institutional control

Continued Federal control of the Yucca Mountain Repository site including access control, maintenance, monitoring, and surveillance of facilities and waste. See *institutional control*.

### affected environment

For an EIS, a description of the existing *environment* (that is, site description) covering information that relates directly to the scope of the *Proposed Action*, the *No-Action Alternative*, and the *implementing alternatives* being analyzed; in other words, the information necessary to assess or understand the *impacts*. This description must contain enough detail to support the impact analysis. The information must highlight “environmentally sensitive resources,” if present; these include floodplains and wetlands, *threatened* and *endangered species*, prime and unique agricultural lands, and property of historic, archaeological, or architectural significance.

### air lock

A chamber or room in which air pressure can be regulated, usually between two regions of unequal pressure. The isolation air locks each consist of two *bulkheads* with doors that open and close in sequence.

air quality

A measure of the quantity of pollutants, measured individually, in the air.

ALARA

See *as low as reasonably achievable*.

alcove

A small excavation (room) off the main tunnel of a repository used for scientific study or for installing equipment.

alkali flat

A level area or plain in an *arid* or semiarid region encrusted with alkali salts that become concentrated by evaporation and poor drainage. *Cap.* (Alkali Flat): An example of such terrain, approximately 25 miles south of Amargosa Valley along the Amargosa River.

alluvial fan

A low, outspread, relatively flat to gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or broad valley.

alluvium

Sedimentary material deposited by flowing water.

alpha particle

A positively charged particle ejected spontaneously from the *nuclei* of some *radioactive* elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See *ionizing radiation*.

alternative

One of two or more actions, processes, or propositions from which a *decisionmaker* will determine the course to be followed. The *National Environmental Policy Act*, as amended, states that in preparing an EIS, an agency “shall ... (s)udy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources” [42 USC 4321, Title I, Section 102 (E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section in an EIS is “the heart of the environmental impact statement” (40 CFR 1502.14), and include rules for presenting the alternatives, including no action, and their estimated impacts.

This EIS has two alternatives: the *Proposed Action* under which DOE would construct, operate and monitor, and eventually close a *monitored geologic repository* for the *disposal* of *spent nuclear fuel* and *high-level radioactive waste* at Yucca Mountain, and the *No-Action Alternative* under which DOE would end *site characterization* activities at Yucca Mountain and continue to accumulate spent nuclear fuel and high-level radioactive waste at commercial storage sites and DOE facilities. The *Nuclear Waste Policy Act* states that this EIS does not have to discuss alternatives to geologic disposal or alternative sites to Yucca Mountain; DOE included the analysis of the No-Action Alternative to provide a basis for comparison with the Proposed Action. See *implementing alternative*.

DOE will base its decision on whether the repository program should proceed toward a site recommendation for Yucca Mountain in part on the Final EIS.

**Amargosa Desert**

A broad northwest-trending basin between the Yucca Mountain area on the north and the Death Valley area to the south.

**Amargosa River**

The main drainage system of the *Amargosa Desert*. The Amargosa River drainage basin originates in the Pahute Mesa-Timber Mountain area north of Yucca Mountain and includes the main tributary systems of *Beatty Wash* and *Fortymile Wash*. The river, which is frequently dry along much of its length, flows southeastward through the Amargosa Desert and ends in the internal drainage system of Death Valley. In southwestern Nevada, the river flows through the Amargosa Valley.

**ambient**

(1) Undisturbed, natural conditions such as ambient temperature caused by climate or natural *subsurface* thermal gradients. (2) Surrounding conditions.

**ambient air**

The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in the immediate proximity to emission sources.

**ambient air quality standards**

Standards established on a Federal or state level that define the limits for airborne concentrations of designated *criteria pollutants* [nitrogen dioxide, *sulfur dioxide*, *carbon monoxide*, *particulate matter* with aerodynamic diameters less than 10 microns ( $PM_{10}$ ), *ozone*, and lead] to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards). See *criteria pollutants*.

**analyzed land withdrawal area**

See *land withdrawal area*.

**aquifer**

A *subsurface* saturated rock unit (formation, group of formations, or part of a formation) of sufficient *permeability* to transmit *groundwater* and yield usable quantities of water to wells and springs.

**aquitard**

A leaky confining bed that transmits water at a very slow rate to or from an adjacent *aquifer*.

**areal mass loading**

The amount of *heavy metal* (usually expressed in metric tons of uranium or equivalent) emplaced per unit area in the proposed repository.

**arid**

Very dry, lacking moisture. Lacking in vegetation.

**as low as reasonably achievable**

A process that applies a graded approach to reducing *dose* levels to workers and the public, and releases of *radioactive* materials to the *environment*. The goal of this process, often referred to as *ALARA*, is not merely to reduce doses, but to reduce them to levels that are as low as reasonable achievable.

assembly

See *fuel assembly*.

atmospheric dispersion

Movement of a *contaminant* as a result of the cumulative effect of the wind patterns and random motions of the air.

atomic mass

The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See *atomic weight*.

atomic number

The number of protons in an atom's nucleus.

atomic weight

The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative *atomic mass*.

backfill

(1) The general fill placed in excavated areas of an underground facility; backfill for the proposed repository would be *tuff*. (2) The material or process used to refill an excavation.

background radiation

*Radiation* from cosmic sources, naturally occurring *radioactive* materials such as granite, and global fallout from nuclear testing.

Bare Mountain

An upfaulted mountain block that bounds the west side of *Crater Flat*.

barrier

Any material, structure, or condition (as a thermal barrier) that prevents or substantially delays the movement of water or *radionuclides*. See *natural barrier*.

basalt

A dark gray to black, dense to fine-grained *igneous* rock.

baseline

Documentation of current conditions so that changes can be identified.

Beatty Wash

A tributary drainage to the *Amargosa River*; drains the west and north sides of the Yucca Mountain area.

berm

A mound or wall of earth.

beta particle

A negative or positive *electron* emitted from a *nucleus* during beta decay, which is a radioactive transformation of a nuclide in which the atomic number increases or decreases by 1 and the mass number remains unchanged. See *ionizing radiation*.

**biosphere**

The ecosystem of the Earth and the living *organisms* inhabiting it.

**block-bounding fault**

A high-angle, normal fault with relatively large displacement that bounds one or both sides of the fault-block mountains typical of the Basin and Range province.

**boiling-water reactor (BWR)**

A *nuclear reactor* that uses boiling water to produce steam to drive a turbine.

**borehole**

A hole made with a drill, auger, or other tool for exploring *strata* in search of minerals, supplying water for blasting, emplacing waste, proving the position of old workings or faults, or releasing accumulations of gas or water. Boreholes include core holes, dry-well-monitoring holes, waste emplacement holes, and test holes for geophysical or *groundwater* characterization.

**borosilicate glass**

*High-level radioactive waste* matrix material in which boron takes the place of the lime used in ordinary glass mixtures.

**borrow areas**

Areas outside the rail corridor where construction personnel could obtain materials to be used in the establishment of a stable platform (subgrade) for the rail track. Aggregate crushing operations could occur in these areas.

**buffer cars**

Railcars in front of or in back of those carrying *spent nuclear fuel* and *high-level radioactive waste* to provide additional distance to possibly occupied railcars or to railcars carrying hazardous materials other than *radioactive* materials. Federal regulations require the separation of a railcar carrying spent nuclear fuel and high-level radioactive waste from a locomotive, occupied caboose, carload of undeveloped film, or railcar carrying another class of hazardous material by at least one buffer car. These could be DOE railcars or, in the case of general freight service, commercial railcars.

**bulkhead**

A wall or embankment in a mine or tunnel that protects against earthslide, fire, water, or gas.

**burnup**

A measure of *nuclear reactor* fuel consumption expressed either as the percentage of fuel atoms that have undergone *fission* or as the amount of energy produced per unit weight of fuel.

**caldera**

An enlarged volcanic crater formed by explosion or collapse of the original crater.

**cancer**

A malignant tumor of potentially unlimited growth, capable of invading surrounding tissue or spreading to other parts of the body.

candidate species

Species for which the Fish and Wildlife Service has enough substantive information on biological status and threats to support proposals to list them as threatened or endangered under the Endangered Species Act. Listing is anticipated but has been precluded temporarily by other listing activities.

canister

A thin-walled, unshielded metal container used as: (1) a pour mold in which molten vitrified *high-level radioactive waste* can solidify and cool; (2) the container in which DOE and electric utilities place intact *spent nuclear fuel*, loose rods, or nonfuel components for shipping or storage; or (3) in general, a container used to provide radionuclide *confinement*. Canisters are used in combination with specialized overpacks that provide structural support, shielding or confinement for storage, transportation, and *emplacement*; overpacks are sometimes referred to as *casks*.

capillary barrier

A contact in the *unsaturated zone* between a *geologic* unit containing relatively small-diameter openings and a unit containing relatively large-diameter openings across which water does not flow.

carbon monoxide

A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a national *ambient air quality standard*.

carbon steel

A steel that is tough but malleable and contains a small percentage of carbon. The outer *barrier* of *waste packages* is composed of carbon steel.

carcinogen

An agent capable of producing or inducing *cancer*.

carcinogenic

Capable of producing or inducing *cancer*.

cask

(1) A heavily shielded container that meets applicable regulatory requirements used to ship *spent nuclear fuel* or *high-level radioactive waste*; (2) a heavily shielded container used by DOE and utilities for the *dry storage* of spent nuclear fuel; usable only for storage, not for transportation to or *emplacement* in a repository.

chain reaction

A process in which some of the *neutrons* released in one *fission* event cause other fissions.

characterization

Activities in the laboratory or the field undertaken to establish the geologic conditions and the ranges of the parameters of a candidate site relevant to the location of a repository. These activities include borings, surface excavations, excavations of exploratory shafts, limited *subsurface* lateral excavations and borings, and *in situ* testing to evaluate the suitability of a candidate site for the location of a repository, but do not include preliminary borings and geophysical testing to assess if *site characterization* should be undertaken.



**Civilian Radioactive Waste Management System**

The organizational system of the DOE Office of Civilian Radioactive Waste Management; it is the composite of the sites and all facilities, systems, equipment, materials, information, activities, and personnel required to perform the activities necessary to manage *radioactive waste disposal*.

**cladding**

The metallic outer sheath of a fuel element generally made of stainless steel or a *zirconium alloy*. It is intended to isolate the fuel element from the external *environment*.

**clastic**

Describing a rock or sediment composed mainly of broken fragments of preexisting minerals or rocks that have been transported from their places of origin.

**climate states**

Representations of climate conditions. Three different climate states are used to represent changes in climate over the periods of interest: present-day dry climate, long-term-average climate (about twice the precipitation of dry climate), and superpluvial climate (about three times the precipitation of dry climate).

**closure**

See *repository phases*.

**co-disposal**

A packaging method for *disposal* of *radioactive waste* in which two types of waste, such as *commercial spent nuclear fuel* and *defense high-level radioactive waste*, are combined in *disposal containers*. Co-disposal takes advantage of otherwise unused space in disposal containers and is more cost-effective than other methods to limit the reactivity of individual *waste packages*.

**collective dose**

See *population dose*.

**colloid**

Small particles in the size range of  $10^{-9}$  to  $10^{-6}$  meters that are suspended in a solvent. Naturally occurring colloids in *groundwater* arise from clay minerals.

**colluvium**

Loose earth material that has accumulated at the base of a hill, through the action of gravity.

**commercial spent nuclear fuel**

Commercial nuclear fuel rods that have been removed from *reactor* use. See *spent nuclear fuel* and *DOE spent nuclear fuel*.

**conceptual model**

A set of *qualitative* assumptions used to describe a system or subsystem for a given purpose. Assumptions for the model should be compatible with one another and fit the existing data within the context of the given purpose of the model.

confinement

As it pertains to *radioactivity*, the retention of *radioactive* material within some specified bounds. Confinement differs from containment in that there is no absolute physical *barrier* in the former.

construction

See *repository phases*.

construction/demolition debris

Discarded solid wastes resulting from the construction, remodeling, repair, and demolition of structures, road building, and land clearing that are inert or unlikely to create an environmental hazard or threaten the health of the general public. Such debris from repository construction would include materials such as soil, rock, masonry materials, and lumber.

construction support areas

Areas along the rail route that could be used as temporary residences for construction crews, material and equipment storage areas, and concrete production areas. Such camps probably would be for the construction of routes far from population centers.

contaminant

A substance that contaminates (pollutes) air, soil, or water. Also, a hazardous substance that does not occur naturally or that occurs at levels greater than those that occur naturally in the surrounding *environment*.

contaminant flux

Movement of a *contaminant* across a surface boundary per unit time (for example, *curies* per year; milligrams per year).

contamination

The intrusion of undesirable elements (unwanted physical, chemical, biological, or radiological substances, or matter that has an adverse effect) to air, water, or land.

controlled area

A surface location, to be marked by suitable monuments, extending horizontally no more than 10 kilometers (6 miles) in any direction from the outer boundary of the underground facility, and the underlying *subsurface*, which area has been committed to use as a *geologic repository* and from which incompatible activities would be prohibited before and after *permanent closure*.

convection

(1) Thermally driven *groundwater* flow or a heat-transfer mechanism for a gas phase. The bulk motion of a flowing fluid (gas or liquid) in the presence of a gravitational field, caused by temperature differences that, in turn, cause different areas of the fluid to have different densities (for example, warmer is less dense). (2) One of the processes that moves solutes in *groundwater*.

corridor

A strip of land in Nevada that encompasses one of several possible routes through which DOE could build a rail line or truck route to transport *spent nuclear fuel*, *high-level radioactive waste*, and other material to and from the Yucca Mountain Repository site.

corrosion

The process of dissolving or wearing away gradually, especially by chemical action.

corrosion-allowance material

*Disposal container* material, such as *carbon steel*, that oxidizes at a predictable rate in a corrosive environment.

corrosion-resistant material

*Disposal container* material, such as Alloy 22, that oxidizes slowly in a corrosive environment.

Crater Flat

A north-trending, 6- to 11-kilometer (4- to 7-mile)-wide area west of Yucca Mountain; bounded by *Bare Mountain* on the west and Yucca Mountain on the east.

credible event/credible accident

An event or *accident* scenario that the design of the *geologic repository* must consider.

criteria pollutants

Six common pollutants (*ozone*, *carbon monoxide*, *particulates*, *sulfur dioxide*, lead, and nitrogen dioxide) known to be hazardous to human health and for which the U.S. Environmental Protection Agency sets National Ambient Air Quality Standards under the Clean Air Act. See *toxic air pollutants*.

critical group

With regard to annual *dose*, the *maximally exposed individuals*. A group of members of the public whose *exposure* is reasonably homogeneous and includes individuals receiving the highest dose. The individuals making up the critical group may change with changes in *source term* and *pathway*.

criticality

The condition in which nuclear fuel sustains a *chain reaction*. It occurs when the number of neutrons present in one generation cycle equals the number generated in the previous cycle.

criticality control

Set of measures taken to maintain nuclear materials, including *spent nuclear fuel*, in a *subcritical* condition during storage, transportation, and *disposal*, so no self-sustaining nuclear *chain reaction* can occur. Subcriticality is maintained by loading spent nuclear fuel in specific configurations that meet requirements related to fuel age, enrichment, and reduction in nuclear fuel reactivity through *burnup*.

cross drift

An approximately 2,800-meter (9,200-foot)-long *drift* excavated to provide researchers new opportunities to study the geologic profile of the rock in the proposed repository area beneath Yucca Mountain. Researchers will conduct a new battery of tests in the cross drift as part of ongoing studies to determine if Yucca Mountain would be a suitable host for a deep *monitored geologic repository* for *spent nuclear fuel* and *high-level radioactive waste*. The cross drift begins inside the *Exploratory Studies Facility* approximately 2,000 meters (6,600 feet) from the northern entrance and cuts through the entire stratigraphic section of the potential Upper Block emplacement area.

**cumulative impact**

The *impact* on the *environment* that results from the incremental impact(s) of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

**curie**

A unit of *radioactivity* equal to 37 billion *disintegrations* per second.

**decay (radioactive)**

The process in which one radionuclide spontaneously transforms into one or more different radionuclides called decay products.

**decibel (dB)**

A standard unit for measuring sound-pressure levels based on a reference sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can hear.

**decibel, A-weighted (dBA)**

A measurement of sound approximating the sensitivity of the human ear and used to characterize the intensity or loudness of sound.

**decisionmaker**

The group or individual responsible for making a decision on constructing and operating a *monitored geologic repository* for the disposal of *spent nuclear fuel* and *high-level radioactive waste* at Yucca Mountain.

**decommissioning**

The process of removing from service a facility in which nuclear materials are handled. It usually involves decontaminating the facility so that it may be dismantled or dedicated to other purposes.

**decontamination**

A process that removes, destroys, or neutralizes chemical, biological, or radiological contamination from a person, object, or area.

**dedicated freight rail service**

A train that handles only one commodity (in this case, *spent nuclear fuel* or *high-level radioactive waste*); this separate train with its own crew would limit switching between trains of the railcars carrying these materials.

**defense in depth**

A strategy based on a system of multiple, independent, and redundant *barriers*, designed to ensure that failure in any one barrier does not result in failure of the entire system.

**deformation**

A change in the shape and size of a body.

**design alternative**

A fundamentally different conceptual design for a repository, which could stand alone as the License Application repository design concept.

design-basis event

Naturally or humanly induced events that are reasonably likely to occur one or more times before permanent closure of the *geologic repository's* operations area; in addition, any other natural or human-induced event that is unlikely, but is sufficiently credible to warrant consideration, taking into account the potential for significant radiological impacts on public health and safety.

design enhancement

An engineered *barrier* system feature that DOE is considering for possible inclusion in the *Viability Assessment* design for the Yucca Mountain Repository. Design enhancements are not considered to be essential to the successful performance of the repository. The EIS analysis of the *Proposed Action* will not include design enhancements, but will identify them as possible means of *mitigation*. If a design enhancement is added to the reference design in time for inclusion in the EIS, it will be evaluated as part of the Proposed Action design.

design feature

A specific element or attribute of the repository for which postclosure (long-term) performance could be evaluated independently of a specific repository design alternative or other design features.

deterministic

A single calculation using only a single value for each of the model parameters. A deterministic system is governed by definite rules of system behavior leading to cause and effect relationships and predictability. Deterministic calculations do not account for *uncertainty* in the physical relationships or parameter values.

dip-slip fault

A fault in which the relative displacement is along the direction of dip of the fault plane. If the block above the fault has moved downward it is a *normal fault*; upward movement indicates a *reverse fault*.

direct impact

Effect that results solely from the construction or operation of a proposed action without intermediate steps or processes. Examples include habitat destruction, soil disturbance, air emissions, and water use.

disintegration

Any transformation of a *nucleus*, whether spontaneous or induced by *irradiation*, in which the nucleus emits one or more particles or *photons*.

disposable canister

A canister for *spent nuclear fuel* or *high-level radioactive waste* with specialized overpacks to enable storage, transportation, and *emplacement* in a repository.

disposal

The *emplacement* in a repository of *high-level radioactive waste*, *spent nuclear fuel*, or other highly *radioactive* material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the *isolation* of such waste from the *accessible environment*.

**disposal container**

The *barrier* or shell, spacing structures or baskets, integral shielding, and packing and other absorbent materials inside or immediately surrounding the container (that is, attached to its outer surface). The disposal container would contain *spent nuclear fuel* and *high-level radioactive waste*, but would exist only after the outer lid weld is complete and accepted. The disposal container would not include the waste form or the encasing containers or canisters (high-level radioactive waste canisters, *DOE spent nuclear fuel* canisters, disposable canisters of *commercial spent nuclear fuel*, etc.).

**disproportionately high and adverse human health effects**

Effects that occur when *impacts* to a *minority population* or *low-income population* from exposure to an environmental hazard significantly exceed the impacts to the general population and, where available, to an appropriate comparison group.

**disproportionately high and adverse environmental impacts**

An environmental *impact* that is unacceptable or above generally accepted norms; these would include economic impacts of the *Proposed Action*. A disproportionately high impact is one (or the risk of one) to a *low-income population* or *minority population* that significantly exceeds the impact to the general population. In assessing cultural and aesthetic impacts, agencies consider impacts that would have unique effects on geographically dislocated or dispersed low-income or minority populations.

**disruptive event**

An unexpected event which, in the case of the repository, includes *human intrusion*, volcanic activity, *seismic* activity, and nuclear *criticality*. Disruptive events have two possible effects; (1) direct release of *radioactivity* to the surface, or (2) alteration of the expected behavior of the system.

**dissolution**

Change from a solid to a liquid state. Dissolving a substance in a solvent.

**DOE spent nuclear fuel**

*Radioactive* waste created by defense activities that consists of over 250 different types of *spent nuclear fuel* and is expected to contribute 2,333 *metric tons of heavy metal (MTHM)* to the total repository. The major contributor to this waste form is the N-reactor fuel currently stored at the Hanford Site. This waste form also includes 65 MTHM of *naval spent nuclear fuel*.

**dose**

The amount of *radioactive* energy that passes the exchange boundaries of an *organism* (skin, mucous membrane, etc.) and is taken into living tissues. Dose arises from a combination of the energy imparted by the *radiation* and the absorption efficiency of the affected organism or tissues. It is expressed in terms of units of the radiation taken in, the body weight or mass impacted, and the time over which the dose occurs or the *impact* is measured.

**dose equivalent**

(1) The number (corrected for background) zero and above that is recorded as representing an individual's *dose* from external *radiation* sources or internally deposited *radioactive* materials; (2) the product of the absorbed dose in *rads* and a quality factor; (3) the product of the absorbed dose, the quality factor, and any other modifying factors. The dose equivalent quantity is used for comparing the biological effectiveness of different kinds of radiation (based on the quality of radiation and its spatial distribution in the body) on a common scale; it is expressed in *rem*.

drift

From mining terminology, a horizontal underground passage. The nearly horizontal underground passageways from the *shaft(s)* to the *alcoves* and rooms. Includes excavations for *emplacement* (emplacement drifts) and access (access mains).

drip shield

A sheet of impermeable material placed above the *waste package* to prevent seeping water from directly contacting the waste packages.

dry storage

Storage of *spent nuclear fuel* without immersing the fuel in water for cooling or shielding; it involves the encapsulation of spent fuel in a steel cylinder that might be in a concrete or massive steel *cask* or structure.

dual-purpose canister

A containment vessel structure specifically designed to store and transport *commercial spent nuclear fuel*.

earthquake

A series of elastic waves in the crust of the Earth caused by abrupt movement easing strains built up along *geologic* faults or by volcanic action and resulting in movement of the Earth's surface.

electron

A stable elementary particle that is the negatively charged constituent of ordinary matter.

emplacement

The act of placing *waste packages* in prepared positions.

endangered species

A species that is in danger of extinction throughout all or a significant part of its range; a formal listing of the Fish and Wildlife Service under the Endangered Species Act.

Energy Policy Act of 1992

Legislation that amends the *Nuclear Waste Policy Act* by directing (1) the Environmental Protection Agency to set site-specific public health and safety radiation protection standards from Yucca Mountain, and (2) the Nuclear Regulatory Commission to modify its technical requirements and licensing criteria to be consistent with the Environmental Protection Agency site-specific standards.

engineered barrier system

The *waste packages* and the underground facility. These are the designed, or engineered, components of the disposal system and the waste package.

enhanced design alternative

A combination (or variation) of one or more design alternatives and design features.

environment

(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an *organism*.

**environmental impact statement (EIS)**

A detailed written statement to support a decision to proceed with major Federal actions affecting the quality of the human *environment*. This is required by the *National Environmental Policy Act*. The EIS describes:

“...the environmental impact of the proposed action; any adverse environmental effects which cannot be avoided should the proposal be implemented; alternatives to the proposed action (although the Nuclear Waste Policy Act, as amended, precludes consideration of certain alternatives); the relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.”

Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments. A Final EIS for the Yucca Mountain site is scheduled for publication in Fiscal Year 2000.

**environmental justice**

The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be subject to disproportionate negative environmental *impacts* of pollution or environmental hazards.

**environmental monitoring**

The process of sampling and analyzing environmental media in and around a facility to (1) confirm compliance with performance objectives and (2) detect *contamination* entering the *environment* to facilitate timely remedial action.

**equilibrium**

The state of a chemical system in which the phases do not undergo any spontaneous change in properties or proportions with time; a dynamic balance.

**erionite**

A natural fibrous *zeolite* in the rocks at Yucca Mountain that is listed as a known human carcinogen by recognized international agencies such as the International Agency for Research on Cancer.

**escort cars**

Railcars in which escort personnel would travel on trains carrying *spent nuclear fuel* or *high-level radioactive waste*.

**evapotranspiration**

The combined processes of evaporation and plant *transpiration* that remove water from the soil and return it to the air.

**Exploratory Studies Facility**

An underground laboratory at Yucca Mountain that includes an 8-kilometer (5-mile) main loop (tunnel), a 3-kilometer (2-mile) *cross drift*, and a research *alcove* system constructed for performing underground studies during *site characterization*. The data collected will contribute toward determining the suitability of the Yucca Mountain site as a repository. Some or all of the facility could be incorporated into the proposed repository.



exposure (to radiation)

The incidence of *radiation* on living or inanimate material by accident or intent. Background exposure is the exposure to natural *ionizing radiation*. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.

exposure pathway

The course a chemical or physical agent takes from the source to the exposed *organism*; describes a unique mechanism by which an individual or population can become exposed to chemical or physical agents at or originating from a release site. Each exposure pathway includes a source or a release from a source, an exposure point, and an exposure route.

far-field

The area of the geosphere and *biosphere* far enough away from the repository that, when numerically modeled, releases from the repository are represented as a homogeneous, single-source effect.

fault

A fracture in rock along which movement of one side relative to the other has occurred.

Fiscal Year

A 12-month period to which a jurisdiction's annual budget applies and at the end of which its financial position and the results of its operations are determined. For example, the Fiscal Year for Clark and Nye Counties, the Cities of Las Vegas and North Las Vegas, the Towns of Tonopah and Pahrump, and the Clark County and Nye County School Districts runs from July 1 through the following June 30; the Federal Fiscal Year runs from October 1 through the following September 30.

fission

The splitting of a *nucleus* into at least two other nuclei, resulting in the release of two or three *neutrons* and a relatively large amount of energy.

fission products

A complex mixture of radionuclides produced by the process of *fission* that includes *radioactive* and nonradioactive radionuclides as well as the decay products of the *radioactive decay* of these nuclides. This can result in more than 200 *isotopes*.

Fortymile Wash

A major tributary to the *Amargosa River*; drains *Jackass Flats* to the east of Yucca Mountain; usually dry along most of its length.

fracture

A general term for any break in a rock, whether or not it causes displacement, caused by mechanical failure from stress. Fractures include cracks, joints, and *faults*. Fractures can act as pathways for rapid *groundwater* movement.

fuel assembly

A number of fuel elements held together by structural materials, used in a *nuclear reactor*. Sometimes called a fuel bundle.

fugitive dust

*Particulate matter* composed of soil; can include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is removed or redistributed.

fugitive emissions

Emissions released directly into the *atmosphere* that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

GENII

A *deterministic* computer software code that evaluates *dose* from the migration of radionuclides introduced into the *accessible environment*, or *biosphere*, that may eventually affect humans through ingestion, inhalation, or direct *radiation*. It is used to develop biosphere dose conversion factors.

gamma ray

The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. *See ionizing radiation.*

general freight rail service

Railroad line service that uses trains that move railcars, each of which might contain a different commodity. Railcars carrying *spent nuclear fuel* or *high-level radioactive waste* could be switched (in railyards or on sidings) successively from one general freight train to another as they traveled from the commercial and DOE locations to Nevada.

geologic

Of or related to a natural process acting as a dynamic physical force on the Earth (faulting, erosion, mountain building resulting in rock formations, etc.).

geologic repository

A system for disposing of *radioactive* waste in excavated *geologic* media, including surface and *subsurface* areas of operation, and the adjacent part of the geologic setting that provides *isolation* of the radioactive waste in the *controlled area*.

Great Basin

A subprovince of the Basin and Range province, generally characterized by north-trending mountain ranges and intervening basins, stretching from eastern Oregon to southern California.

Greater-Than-Class-C waste

Low-level nuclear waste generated by the commercial sector that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class-C low-level waste, as specified in 10 CFR Part 61. DOE is responsible for disposing of this type of waste from its nondefense programs.

ground support

The system (rock bolt with wire mesh, steel cast, cast or precast concrete sections) used to line the main and emplacement *drifts* to minimize rock or earth falling into the drifts.

groundwater

Water contained in pores or fractures in either the *unsaturated zone* or *saturated zone* below ground level.

habitat

Area in which a plant or animal lives and reproduces.

half-life (radiological)

The time in which half the atoms of a *radioactive* substance decay to another nuclear form. Half-lives range from millionths of a second to billions of years depending on the stability of the nuclei.

hazardous chemical

As defined under the Occupational Safety and Health Act and the Community Right-to-Know Act, a chemical that is a physical or health hazard.

hazardous pollutant

Hazardous chemical that can cause serious health and environmental hazards, and listed on the Federal list of hazardous air pollutants (42 USC 7412). See *toxic air pollutants*.

hazardous waste

Waste designated as hazardous by the Environmental Protection Agency or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act, is waste that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed of. Hazardous wastes appear on special Environmental Protection Agency lists or possess at least one of the following characteristics: ignitability, corrosivity, toxicity, or reactivity. Hazardous waste streams from the repository could include certain used rags and wipes contaminated with solvents.

heavy-haul truck

An overweight, overdimension vehicle that must have permits from state highway authorities to use public highways; a vehicle DOE would use on public highways to move *spent nuclear fuel* or *high-level radioactive waste shipping casks* designed for a railcar.

heavy metal

All uranium, plutonium, and thorium used in a manmade *nuclear reactor*.

high-efficiency particulate air filter

A filter with an efficiency of at least 99.95 percent that separates particles from an air exhaust stream before the air is released to the atmosphere.

high-level radioactive waste

(1) The highly *radioactive* material that resulted from the reprocessing of *spent nuclear fuel*, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains *fission* products in sufficient concentrations. (2) Other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent *isolation*.

Highway Route-Controlled Quantities of Radioactive Material

Thresholds for certain quantities of *radioactive* materials above which shipments are subject to specific routing controls that apply to the highway carrier. These thresholds are defined by U.S. Department of Transportation regulations (49 CFR Part 177). (49 CFR Part 397 Subpart D defines routing requirements.)

horizon

See *repository horizon*.

human intrusion

The inadvertent disturbance of a *disposal* system by the activities of humans that could result in release of *radioactive* waste. 40 CFR Part 191 Subpart B requires that *performance assessments* consider the possibility of human intrusion.

hydrogeology

A study that encompasses the interrelationships of *geologic* materials and processes involving water.

hydrographic area

A groundwater basin.

hydrology

(1) The study of water characteristics, especially the movement of water. (2) The study of water, involving aspects of geology, oceanography, and meteorology.

igneous

(1) A type of rock formed from a molten, or partially molten, material. (2) An activity related to the formation and movement of molten rock either in the *subsurface* (plutonic) or on the surface (volcanic).

impact

For an EIS, the positive or negative effect of an action (past, present, or future) on the natural *environment* (land use, air quality, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (infrastructure, economics, social, and cultural).

implementing alternative

An action or proposition by DOE necessary to implement the *Proposed Action* and to enable the estimation of the range of reasonably foreseeable *impacts* of that action or proposition.

- The implementing rail/intermodal alternatives for Nevada transportation are the five corridors for a new rail spur:
  - Carlin
  - Caliente
  - Caliente-Chalk Mountain
  - Jean
  - Valley Modified
- The five *intermodal transfer station*/heavy-haul route combinations:
  - Caliente intermodal transfer station, Caliente route
  - Caliente intermodal transfer station, Caliente-Chalk Mountain route
  - Caliente intermodal transfer station, Caliente-Las Vegas route
  - Sloan/Jean intermodal transfer station, Sloan/Jean route
  - Apex/Dry Lake intermodal transfer station, Apex/Dry Lake route

DOE decisions on implementing alternatives will be made when they are ripe for decisionmaking, which might occur after a decision to construct and operate the Yucca Mountain Repository.

inadvertent intrusion

The disturbance of a *disposal* facility or its immediate *environment* by a future occupant that could result in a loss of *containment* of the waste or *exposure* of people.

indirect impact

An effect that is related to but removed from a proposed action by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.

industrial wastewater

Liquid wastes from industrial processes that do not include sanitary sewage. Repository industrial wastewater would include water used for dust suppression and process water from building heating, ventilation, and air conditioning systems.

inert

Lacking active thermal, chemical, or biological properties. An inert atmosphere is incapable of supporting combustion.

infiltration

The process of water entering the soil at the ground surface and the ensuing movement downward when the water input at the soil surface is adequate. Infiltration becomes *percolation* when water has moved below the depth at which it can return to the atmosphere by evaporation or *evapotranspiration*.

infrastructure

Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems. These include surface and *subsurface* facilities (for example, service drifts, transporters, electric power supplies, waste handling buildings, administrative facilities).

in situ

In its natural position or place. The phrase distinguishes in-place experiments, conducted in the field or underground facility, from those conducted in the laboratory.

institutional control

Monitoring and maintenance of storage facilities to ensure that radiological releases to the *environment* and *radiation* doses to workers and the public remain within Federal limits and DOE Order requirements.

intermodal transfer station

A facility at the juncture of rail and road transportation used to transfer *shipping casks* containing *spent nuclear fuel* and *high-level radioactive waste* from rail to truck and empty casks from truck to rail.

intermodal transfer station candidate area

Area near one or more existing main rail lines that DOE is considering for the location of an *intermodal transfer station*.

intrusive sound

A new sound that, either because of its loudness in relation to the local *ambient* sound level, or because of such characteristics as tone content, impulsive or unexpected nature, or high information content, is annoying or detracts from the usual ambiance of the receptor location. See *noise*.

invert

(1) The low point of something such as a tunnel, *drift*, or drainage channel. (2) An engineered structure or material placed on excavated drift floors (the low points) to serve as structural support for drift transportation or *emplacement* systems. (For precast concrete, the proper name is invert segments, but they are commonly referred to simply as inverts.) Typical inverts (segments) convert rounded excavated floors to flat level surfaces for transportation system use. Emplacement drift inverts may be specially designed to enhance the waste *isolation* and *criticality* prevention capabilities of the proposed repository through choice of invert materials or invert shape. Inverts might also be used to help channel water to improve repository drainage.

involved worker

A worker who would be directly involved in the activities related to facility construction and operations, including excavation activities; receipt, handling, packaging, and *emplacement* of waste materials; and *monitoring* of the condition and performance of the *waste packages*. See *noninvolved worker*.

ion

(1) An atom that contains excess *electrons* or is deficient in electrons, causing it to be chemically active. (2) An electron not associated with a *nucleus*.

ionizing radiation

(1) *Alpha particles*, *beta particles*, *gamma rays*, *X-rays*, *neutrons*, high-speed *electrons*, high-speed *protons*, and other particles capable of producing *ions*. (2) Any radiation capable of displacing electrons from an atom or molecule, thereby producing ions.

irradiation

Exposure to *radiation*.

isolation

Inhibiting the transport of *radioactive* material so that the amounts and concentrations of this material entering the *accessible environment* stay within prescribed limits.

isotope

One of two or more atomic *nuclei* with the same number of *protons* (that is, the same *atomic number*) but with a different number of *neutrons* (that is, a different *atomic weight*). For example, uranium-235 and uranium-238 are both isotopes of uranium.

Jackass Flats

A broad asymmetric basin 8 to 10 kilometers (5 to 6 miles) wide and 20 kilometers (12 miles) long that is east of Yucca Mountain and is drained by *Fortymile Wash*.

juvenile failure

Premature failure of a *waste package* because of material imperfections or damage by rockfall during *emplacement*.

land withdrawal area

An area of Federal property set aside for the exclusive use of a Federal agency. For the analyses in this EIS, DOE used an assumed land withdrawal area of 600 square kilometers, or 150,000 acres.

Las Vegas Valley shear zone

A major right-lateral strike-slip zone of faulting.

latent cancer fatalities

Deaths resulting from *cancer* that has become active after a latent period (that is, the period after exposure).

legal-weight truck

A truck with a gross vehicle weight (both truck and cargo weight) of less than 36,300 kilograms (80,000 pounds), the loaded weight limit for commercial vehicles operated on public highways without special state-issued permits. In addition, the dimensions, axle spacing, and, if applicable, axle loads of these vehicles must be within Federal and state regulations.

License Application

An application to the Nuclear Regulatory Commission for a license to construct a repository.

lithology

The study and description of the general, gross physical characteristics of a rock, especially sedimentary *clastics*, including color, grain size, and composition.

lost workday cases

Incidents that result in injuries that cause the loss of work time.

low-income population

One in which 25 percent or more of the persons in the population live in poverty, as reported by the Bureau of the Census in accordance with Office of Management and Budget requirements.

low-level radioactive waste

*Radioactive* waste that is not classified as *high-level radioactive waste*, *transuranic waste*, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries.

maintenance

Activities during the repository operation and monitoring phase including maintenance of *subsurface* monitoring and instrumentation systems and utilities (compressed air, water supply, fire water, wastewater system, power supply, and lights), maintenance of the main ventilation fan installations and surface facilities related to underground activities, and site security. Maintenance also preserves the capability to retrieve emplaced *disposal containers*. See *repository phases*.

matrix (geology)

The solid, but porous, portion of rock.

**maximally exposed individual**

A hypothetical individual whose location and habits result in the highest total radiological or chemical *exposure* (and thus *dose*) from a particular source for all *exposure* routes (for example, inhalation, ingestion, direct exposure). For evaluating the potential postclosure radiological impacts to the public, “maximally exposed individual” is interchangeable with “reasonably maximally exposed individual.”

**Maximum Contaminant Level**

Under the Safe Drinking Water Act, the maximum permissible concentrations of specific constituents in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people; the standards established as maximum contaminant levels consider the feasibility and cost of attaining the standard.

**maximum reasonably foreseeable accidents**

Accidents characterized by extremes of mechanical (impact) forces, heat (fire), and other conditions that would lead to the highest foreseeable consequences. In general, accidents with conditions that have a chance of occurring more often than 1 in 10 million in a year are considered to be reasonably foreseeable.

**metamorphic**

Rock in which the original mineralogy, texture, or composition has changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

**metric tons of heavy metal (MTHM)**

Quantities of *spent nuclear fuel* without the inclusion of other materials such as *cladding* (the tubes containing the fuel) and structural materials. A metric ton is 1,000 kilograms (1.1 tons or 2,200 pounds). Uranium and other metals in spent nuclear fuel (such as thorium and plutonium) are called *heavy metals* because they are extremely dense; that is, they have high weights per unit volume.

**millirem**

One one-thousandth (0.001) of a *rem*.

**minority population**

A community in which the percent of the population of a racial or ethnic minority is 20 points higher than the percent found in the population as a whole.

**mitigation**

Actions and decisions that (1) avoid *impacts* altogether by not taking a certain action or parts of an action, (2) minimize impacts by limiting the degree or magnitude of an action, (3) rectify the impact by repairing, rehabilitating, or restoring the *affected environment*, (4) reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action, or (5) compensate for an impact by replacing or providing substitute resources or *environments*.

**mixed-oxide fuel**

A mixture of uranium oxide and plutonium oxide that could be used to power commercial nuclear reactors.



**monitored geologic repository**

A system, requiring licensing by the U.S. Nuclear Regulatory Commission, intended or used for the permanent underground *disposal* of *radioactive* waste (including *spent nuclear fuel*). A *geologic repository* includes (1) the geologic repository operations area, and (2) the geologic setting in the *controlled area* that provides *isolation* of the radioactive waste. The repository would be monitored between *emplacement* of the last *waste package* and closure.

**monitoring**

Activities during the repository operation and monitoring phase including the surveillance and testing of *waste packages* and the repository for *performance confirmation*. See *repository phases*.

**National Environmental Policy Act**

The Federal statute that is the national charter for protection of the *environment*. The Act is implemented by procedures issued by the Council on Environmental Quality and DOE. The National Environmental Policy Act of 1969 appears at 42 USC 4321 *et seq*.

**natural barrier**

The physical, mechanical, chemical, and hydrologic characteristics of the geologic *environment* that individually and collectively act to minimize or prevent radionuclide transport. See *barrier*.

**natural system**

A host rock suitable for repository construction and waste *emplacement* and the surrounding rock formations. It includes *natural barriers* that provide *containment* and *isolation* by limiting radionuclide transport through the geohydrologic *environment* to the *biosphere* and provide conditions that will minimize the potential for *human intrusion* in the future.

**naval spent nuclear fuel**

*Spent nuclear fuel* discharged from reactors in surface ships, submarines, and training reactors operated by the U.S. Navy.

**near-field**

The area of and conditions in the repository including the *drifts* and *waste packages* and the rock immediately surrounding the drifts. The region around the repository where the natural hydrogeologic system would be significantly impacted by the excavation of the repository and the *emplacement* of waste.

**neutron**

An atomic particle with no charge and an atomic mass of 1; a component of all atoms except hydrogen; frequently released as *radiation*.

**nitrogen oxides**

Gases formed in great part from atmospheric nitrogen and oxygen when combustion occurs under conditions of high temperature and high pressure; a major air pollutant. Two primary nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), are important airborne *contaminants*. In the presence of sunlight, nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide, which in high concentrations can cause lung damage.

**No-Action Alternative**

One of the *alternatives* to be assessed in an EIS. The regulations of the Council on Environmental Quality (40 CFR Parts 1500 through 1508) direct Federal agencies to use the process established by the *National Environmental Policy Act* to identify and assess reasonable alternatives, including “no action.” For this EIS, under the No-Action Alternative DOE would end *site characterization* activities at Yucca Mountain and continue to accumulate *spent nuclear fuel* and *high-level radioactive waste* at commercial storage sites and DOE facilities.

**noble gas**

Any of a group of rare gases that include helium, neon, argon, krypton, xenon, and sometimes radon and that exhibit great stability and extremely low reaction rates; also called *inert* gas.

**noise**

Any sound that is undesirable because it interferes with speech and hearing; if intense enough, it can damage hearing.

**noninvolved worker**

A worker who would perform managerial, technical, supervisory, or administrative activities but would not be directly involved in construction, excavation, or operations activities. See *involved worker*.

**normal fault**

A *fault* in which the relative displacement is along the direction of dip of the fault plane (*dip-slip fault*) where the block above the fault has moved downward in relation to the block below the fault. See *reverse fault*.

**nuclear radiation**

*Radiation* that emanates from an unstable atomic *nucleus*.

**nuclear reactor**

A device in which a nuclear *fission chain reaction* can be initiated, sustained, and controlled to generate heat or to produce useful radiation.

**nuclear waste**

Unusable by-products of nuclear power generation, nuclear weapons production, and research, including *spent nuclear fuel*, *high-level radioactive waste*.

**Nuclear Waste Policy Act (42 USC 10101 *et seq.*)**

The Federal statute enacted in 1982 that established the Office of Civilian Radioactive Waste Management and defined its mission to develop a Federal system for the management and geologic disposal of *commercial spent nuclear fuel* and other *high-level radioactive wastes*, as appropriate. The Act also specified other Federal responsibilities for nuclear waste management, established the Nuclear Waste Fund to cover the cost of geologic *disposal*, authorized interim storage under certain circumstances, and defined interactions between Federal agencies and the states, local governments, and Native American tribes. The Act was substantially amended in 1987 (see *Nuclear Waste Policy Act Amendments of 1987*) and 1992 (see *Energy Policy Act of 1992*)

### Nuclear Waste Policy Act Amendments of 1987 (Public Law 100-203)

Legislation that amended the *Nuclear Waste Policy Act* to limit repository *site characterization* activities to Yucca Mountain, Nevada; establish the Office of Nuclear Waste Negotiator to seek a state or Native American tribe willing to host a repository or monitored retrievable storage facility; create the *Nuclear Waste Technical Review Board*; and increase state and local government participation in the waste management program.

### Nuclear Waste Technical Review Board

An independent body established within the executive branch, created by the *Nuclear Waste Policy Amendments Act of 1987* to evaluate the technical and scientific validity of activities undertaken by the U.S. Department of Energy, including *site characterization* activities and activities relating to the packaging or transportation of *high-level radioactive waste* or *spent nuclear fuel*. Members of this Board are appointed by the President from a list prepared by the National Academy of Sciences.

### nucleus

The central, positively charged, dense portion of an atom. Also known as atomic nucleus.

### nuclide

An atomic *nucleus* specified by its *atomic weight*, *atomic number*, and energy state; a radionuclide is a *radioactive* nuclide.

### oblique-slip fault

A *fault* that combines some purely horizontal motion (*strike-slip fault*) with some, along the direction of the dip of the fault plane (*dip-slip fault*).

### offsite

Physically not in a repository-related area managed by DOE.

### onsite

Physically in an area managed by DOE where access can be limited for any reason. The site boundary encompasses *controlled areas*. The site comprises the various Operations Areas and the areas between and immediately surrounding them.

### operational storage

A storage capacity DOE could use to collect material shipped to the repository before (or after) its insertion in *waste packages* and *emplacement* in the repository.

### operations

See *repository phases*.

### organism

An individual constituted to carry on the activities of life by means of organs separate but mutually dependent; a living being.

### overburden

*Geologic* material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials. As used by the Yucca Mountain Project, this is geologic material overlying the mined *repository horizon*.

overweight, overdimension truck

Semi- and tandem tractor-trailer trucks with gross weights over 80,000 pounds that must obtain permits from state highway authorities to use public highways.

ozone (O<sub>3</sub>)

The triatomic form of oxygen; in the *stratosphere*, ozone protects the Earth from the Sun's *ultraviolet radiation*, but in lower levels of the atmosphere it is an air pollutant.

Paleozoic Era

A geologic era extending from the end of the Precambrian to the beginning of the Mesozoic, dating from about 600 to 230 million years ago.

particulate matter

Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. See *PM<sub>10</sub>*.

pathway

A potential route by which radionuclides might reach the *accessible environment* and pose a threat to humans.

pediment

A planar sloping rock surface forming a ramp to a front of a mountain range in an arid region. It might be covered locally by a thin *alluvium*.

perched water

A *saturated zone* condition that is not continuous with the *water table*, because there is an impervious or semipervious layer underlying the perched zone or a *fault zone* that creates a *barrier* to water movement and perches water. See *permeable*.

percolation

The passage of a liquid through a porous substance. In rock or soil it is the movement of water through the interstices and pores under hydrostatic pressure and the influence of gravity. The downward or lateral flow of water that becomes net *infiltration* in the *unsaturated zone*.

performance assessment

An analysis that predicts the behavior of a system or system component under a given set of conditions. Performance assessments include estimates of the effects of *uncertainties* in data and modeling. See *Total System Performance Assessment*.

performance confirmation

The program of tests, experiments, and analyses conducted to evaluate the accuracy and adequacy of the information used to determine with reasonable assurance that the performance objectives for the period after *permanent closure* will be met.

permanent closure

Final sealing of *shafts* and *boreholes* of the underground facility.

permeable

Pervious; a permeable rock is a rock, either porous or cracked, that allows water to soak into and pass through it freely.

permeability

In general terms, the capacity of such mediums as rock, sediment, and soil to transmit liquid or gas. Permeability depends on the substance transmitted (oil, air, water, etc.) and on the size and shape of the pores, joints, and fractures in the medium and the manner in which they interconnect. “Hydraulic conductivity” is equivalent to “permeability” in technical discussions relating to *groundwater*.

person-rem

A unit used to measure the *radiation* exposure to an entire group and to compare the effects of different amounts of radiation on groups of people; it is the product of the average *dose equivalent* (in *rem*) to a given organ or tissue multiplied by the number of persons in the population of interest.

pH

A number indicating the acidity or alkalinity of a solution. A pH of 7 indicates a neutral solution. Lower pH values indicate more acidic solutions while higher pH values indicate alkaline solutions.

photon

A massless particle, the quantum of an electromagnetic field, carrying energy, momentum, and angular momentum.

picocurie

One one-trillionth ( $1 \times 10^{-12}$ ) of a *curie*.

PM<sub>2.5</sub>

All *particulate matter* in the air with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (0.0001 inch). A standard for this material as a *criteria pollutant* has been defined but not yet implemented.

PM<sub>10</sub>

All *particulate matter* in the air with an aerodynamic diameter less than or equal to a nominal 10 micrometers (0.0004 inch). Particles less than this diameter are small enough to be breathable and could be deposited in lungs.

population dose

A summation of the radiation doses received by individuals in an exposed population; equivalent to *collective dose*; expressed in *person-rem*.

portal

Surface entrance to a mine, particularly in a *drift* or tunnel. The North and South Portals are the two primary entrances to the *subsurface* facilities.

preferred route

A public highway route that satisfies the requirements of U.S. Department of Transportation regulations (49 CFR Part 397, Subpart D) to be acceptable for shipments of *Highway Route-Controlled Quantities of Radioactive Material*.

pressurized-water reactor (PWR)

A nuclear power *reactor* that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.

probabilistic

(1) Based on or subject to *probability*. (2) Involving a variable factor, such as temperature or porosity. At each instance of time, the factor may take on any of the values of a specified set with a certain probability. Data from a probabilistic process is an ordered set of observations, each of which is one item in a probability distribution.

probability

The relative frequency at which an event can occur in a defined period. Statistical probability is about what actually happens in the real world and can be verified by observation or sampling. Knowing the exact probability of an event is usually limited by the inability to know, or compile the complete set of, all possible outcomes over time or space. Probability is measured on a scale of 0 (event will *not* occur) to 1 (event *will* occur).

probable maximum flood

The hypothetical flood (peak discharge, volume, and hydrographic shape) that is considered to be the most severe reasonably possible, based on comprehensive hydrometeorological application of probable maximum precipitation and other hydrologic factors, such as sequential storms and snowmelts, that are favorable for maximum flood runoff.

proposed action

The activity proposed to accomplish a Federal agency's purpose and need. An EIS analyzes the environmental *impacts* of the Proposed Action. A proposed action includes the project and its related support activities (preconstruction, construction, and operation, along with postoperational requirements). The Proposed Action in this EIS is the construction, operation and monitoring, and eventual closure of a *monitored geologic repository* for *spent nuclear fuel* and *high-level radioactive waste* at Yucca Mountain in Nevada (see *repository project phases*).

proton

An elementary particle that is the positively charged component of ordinary matter and, together with the *neutron*, is a building block of all atomic *nuclei*.

pyroclastic

Of or relating to individual particles or fragments of *clastic* rock material of any size formed by volcanic explosion or ejected from a volcanic vent.

qualitative

With regard to a variable, a parameter, or data, an expression or description of an aspect in terms of non-numeric qualities or attributes. See *quantitative*.

quantitative

A numeric expression of a variable. See *qualitative*.

rad

The unit of measure for the absorbed dose of *radiation*.

radiation

The emitted particles or *photons* from the *nuclei* of *radioactive* atoms. Some elements are naturally radioactive; others are induced to become radioactive by *irradiation* in a *reactor*. Naturally occurring radiation is indistinguishable from induced radiation.

radioactive

Emitting *radioactivity*.

radioactive decay

The process in which one *radionuclide* spontaneously transforms into one or more different radionuclides, which are called decay products.

radioactivity

The property possessed by some elements (for example, uranium) of spontaneously emitting alpha, beta, or *gamma rays* by the *disintegration* of atomic *nuclei*.

radionuclide

See *nuclide*.

rail route

Route from point of origin to the repository.

reactor

See *nuclear reactor*.

reasonably maximally exposed individual

See *maximally exposed individual*.

recharge

The movement of water from an *unsaturated zone* to a *saturated zone*.

recordable cases

Occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) lost workday cases (nonfatal), and (3) the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.

Record of Decision

A document that provides a concise public record of a decision made by a government agency.

region of influence

The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.

rem

The unit of a *dose equivalent* from *ionizing radiation* to the human body. It is used to measure the amount of radiation to which a person has been exposed (rem means Roentgen Equivalent in Man).

remediation

Action taken to permanently remedy a release or threatened release of a hazardous substance to the *environment*, instead of or in addition to removal.

repository

See *geologic repository*.

**repository horizon**

The near-horizontal plane in the host rock stratum where DOE proposes to locate the repository emplacement area(s).

**repository phases**

The development of a monitored geologic repository at Yucca Mountain, if approved, would have three phases, as follows:

- *Construction:* The repository construction phase would begin in 2005 and end in 2010. Activities during this phase would include preparing the site, constructing surface waste handling and support facilities, excavating and equipping a portion of the repository *subsurface* for initial waste *emplacement*, and conducting initial verification testing of components and systems.
- *Operation and monitoring:* Repository operations activities would include waste receipt, repackaging, and emplacement in the repository; continuing subsurface development for waste *emplacement*; *monitoring*; and *maintenance*. Waste receipt, repackaging, and emplacement activities, along with continued construction activities, would begin in about 2010 and would take about 24 years. Monitoring would begin with the initial emplacement of waste in the repository and would end at repository closure. In addition, the maintenance of repository facilities would continue until the closure of the repository. See *monitoring*, *maintenance*.
- *Closure:* The closure of the *subsurface* repository facilities would include the removal and salvage of equipment and materials; filling of the main *drifts*, access ramps, and ventilation shafts; and sealing of openings, including ventilation shafts, access ramps, and *boreholes*. Surface closure activities would include the construction of monuments to mark the repository location, *decommissioning* and demolition of facilities, and restoration of the site to its approximate condition before the construction of the repository facilities. Closure would begin in 2060 at the earliest or as late as 2310 (that is, from 50 to 300 years after the start of emplacement).

**restricted area**

An area of the surface repository enclosed by security fences, control gates, lighting, and detection systems established to prevent the spread of radiological contamination. The area would include the facilities and transportation systems required to receive and ship rail and truck waste shipments, prepare *shipping casks* for handling, and load *waste forms* into disposal containers for *emplacement* in the repository. It would also include the facility and systems required to treat and package site-generated *low-level radioactive waste* for offsite disposal. (Other documents related to the Yucca Mountain Repository refer to this as the Radiologically Controlled Area.)

**retrieval**

The act of removing *radioactive* waste from the underground location at which the waste had been previously emplaced for disposal. Retrieval would be a contingency action, performed only if *monitoring* indicated that the waste needed to be retrieved in order to protect the public health and safety or the environment or to recover resources from *spent nuclear fuel*.



reverse fault

A *fault* in which the relative displacement is along the direction of the dip of the fault plane (*dip-slip fault*), and in which the block above the fault has moved upward in relation to the block below the fault.

riprap

Broken stones or chunks of concrete used as foundation material or in embankments to control water flow or prevent erosion.

risk

The product of the probability that an undesirable event will occur multiplied by the consequences of the undesirable event.

roentgen

The international unit of quantity for X-rays and gamma rays.

safe haven

Designated safe parking locations along transportation routes.

sanitary and industrial solid waste

Solid waste that is neither hazardous nor radioactive. Sanitary waste streams include paper, glass, and discarded office material. State of Nevada waste regulations identify this waste stream as household waste.

sanitary waste

Domestic wastewater from toilets, sinks, showers, kitchens, and floor drains from restrooms, change rooms, and food preparation and storage areas.

saturated zone

The area below the *water table* where all spaces (*fractures* and rock pores) are completely filled with water.

scenario

A specific set of actions, activities, and assumptions. Scenarios are identified and analyzed to enable the estimation of the range of environmental impacts associated with the *Proposed Action* and the *No-Action Alternative*. Scenarios evaluated in this EIS include the high, intermediate, and low *thermal load* scenarios, No-Action Alternative Scenario 1 (continued *institutional control*) and Scenario 2 (no effective institutional controls after 100 years). The environmental impacts identified from these scenarios provide environmental information to support Departmental decisions about the *alternatives* and *implementing alternatives*.

seismic

Pertaining to, characteristic of, or produced by *earthquakes* or earth vibrations.

seismicity

A seismic event or activity such as an *earthquake* or earth tremor; *seismic* action.

shaft

An excavation or vertical passage of limited area, compared to its depth, used to lower personnel and material or to ventilate underground facilities.

shielding

Any material that provides *radiation* protection.

shipment

The movement of a properly prepared (loaded, unloaded, or empty) *cask* from one site to another and associated activities to ensure compliance with applicable regulations.

shipping cask

A heavily shielded massive container that meets regulatory requirements for shipping *spent nuclear fuel* or *high-level radioactive waste*. See *cask*.

single-purpose (storage or transportation) cask

A heavily shielded massive container for the dry storage of *spent nuclear fuel*; it is usable for either storage or transportation but not for *emplacement* in a repository. See *cask*.

site boundary

The boundary of the land withdrawal area used for analytical purposes in this EIS. See *land withdrawal area*.

site characterization

Activities from 1986 to 2000 associated with the determination of the suitability of the Yucca Mountain site as a *monitored geologic repository*. DOE constructed the *Exploratory Studies Facility* to support the following activities related to the determination of site suitability, including surface facilities and *subsurface* ramps and *drifts*:

- Gather and evaluate surface and subsurface site data
- Predict the performance of the repository
- Prepare the repository design
- Assess the performance of the system against the required Code of Federal Regulations and program performance criteria

Some of the exploratory surface and subsurface facilities would be enhanced during the repository construction phase (see *repository phases*); others would be removed, demolished, or relocated, as necessary. Data gathering associated with site characterization would end with the beginning of the construction phase.

site-generated waste

Waste or wastewater generated at the *monitored geologic repository* and related transportation facilities.

soil recovery

The return of disturbed land to a relatively stable condition with a form and productivity similar to that which existed before any disturbance.

sound barrier

Natural or artificial structures that block or interfere with the propagation of sound; examples include terrain features and manmade structures (buildings, walls, etc.).

source term

Types and amounts of radionuclides that are the source of a potential release of *radioactivity*.

spalling

- (1) Flaking off of corrosion products from the metal *substrate* as it undergoes corrosion. The layer of corroded material thickens. The spalling could be caused by an expansive action of the corrosion products because they occupy a greater volume than the uncorroded metal substrate.
- (2) Flaking, chipping, or cracking at the opening of a *borehole*, *shaft*, or other rock excavation.

Special-Performance-Assessment-Required (SPAR) wastes

Low-level radioactive wastes generated in DOE production reactors, research reactors, reprocessing facilities, and research and development activities that exceed the Nuclear Regulatory Commission Class C shallow-land burial disposal limits.

spent nuclear fuel

Fuel that has been withdrawn from a nuclear *reactor* following *irradiation*, the component elements of which have not been separated by reprocessing. For this project, this refers to (1) intact, nondefective *fuel assemblies*, (2) failed fuel assemblies in canisters, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in *pressurized-water reactor* fuel assemblies, (6) fuel channels attached to *boiling-water reactor* fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in *canisters*.

spoils areas

Areas outside the rail corridor for the deposition of excavated materials from rail line development.

stakeholder

A person or organization with an interest in or affected by DOE actions (representatives from Federal, state, tribal, or local agencies; members of Congress or state legislatures; unions, educational groups, environmental groups, industrial groups, etc.; and members of the general public).

storage

The collection and containment of waste or *spent nuclear fuel* in a way that does not constitute *disposal* of the waste or *spent nuclear fuel* for the purposes of awaiting treatment or disposal capacity.

storage cask

See *cask*.

storage container

See *cask*.

stratigraphy

The branch of geology that deals with the definition and interpretation of rock strata, the conditions of their formation, character, arrangement, sequence, age, distribution, and especially their correlation by the use of fossils and other means of identification. See *stratum*.

stratosphere

The atmospheric shell above the troposphere and below the mesosphere. It extends from 10 to 20 kilometers (6 to 12 miles) to about 53 kilometers (33 miles) above the surface.

stratum

A sheetlike mass of sedimentary rock or earth of one kind lying between beds of other kinds.

stream tube

A modeling method used to represent the *groundwater* flow path from the *water table* to the *biosphere*. There are six stream tubes used for *saturated zone* modeling with one tube associated with and having the cross-sectional shape of one of six regions designated at the water table. Each stream tube takes in *groundwater* flux and radionuclide mass flux data at the water table representing flux from the repository that would pass through the *unsaturated zone*.

strike-slip fault

A fault with purely horizontal relative displacement.

subcritical

Having an effective multiplication constant less than 1, so that a self-supporting *chain reaction* cannot be maintained in a *nuclear reactor*.

substrate

Basic surface on which a material adheres.

subsurface

A zone below the surface of the Earth, the *geologic* features of which are principally layers of rock that have been tilted or faulted and are interpreted on the basis of drill hole records and geophysical (*seismic* or rock vibration) evidence. In general, it is all rock and solid materials lying beneath the Earth's surface.

sulfur dioxide

A toxic gas produced from the burning of fossil fuels. It is the main pollutant involved in the formation of acid rain. Coal-burning electric utilities are the major source of sulfur dioxide in the United States. See *criteria pollutants*, *ambient air quality standards*.

sulfur oxides

Pungent, colorless gases formed primarily by the combustion of fossil fuels; considered major air pollutants; sulfur oxides can damage the human respiratory tract and vegetation. See *criteria pollutants*, *ambient air quality standards*.

supernate

A concentrated form of *radioactive* waste that floats to the top of an undisturbed container of liquid *high-level radioactive waste*.

thermal load

The application of heat to a system, usually measured in terms of watts per unit area. The thermal load for a repository is the watts per acre produced by the *radioactive* waste in the active *disposal* area. The spatial density at which waste packages are emplaced within the repository as characterized by the areal power density and the *areal mass loading*.

**threatened species**

A species that is likely to become an *endangered species* within the foreseeable future throughout all or a significant part of its range.

**thrust fault**

A *reverse fault* in which the angle of the fault plane is less than 45 degrees.

**Total System Performance Assessment**

A risk assessment that quantitatively estimates how the proposed Yucca Mountain Repository system would perform under the influence of specific features, events, and processes, incorporating *uncertainty* in the models and data. See *performance assessment*.

**toxic air pollutants**

Hazardous pollutants not listed as either *criteria pollutants* or *hazardous pollutants*.

**transpiration**

The process by which water enters a plant through its root system, passes through its vascular system, and is released into the atmosphere through openings in its outer covering. It is an important process for removal of water that has infiltrated below the zone where it could be removed by evaporation.

**transuranic waste**

Waste materials (excluding high-level radioactive waste and certain other waste types) contaminated with alpha-emitting radionuclides that are heavier than uranium with half-lives greater than 20 years and that occur in concentrations greater than 100 nanocuries per gram. Transuranic waste results primarily from treating and fabricating plutonium as well as research activities at DOE defense installations.

**tuff**

*Igneous* rock formed from compacted volcanic fragments from *pyroclastic* (explosively ejected) flows with particles generally smaller than 4 millimeters (about 0.16 inch) in diameter. The most abundant type of rock at the Yucca Mountain site.

**ultraviolet radiation**

Electromagnetic radiation with wavelengths from 4 to 400 nanometers. This range begins at the short wavelength limit of visible light and overlaps the wavelengths of long *x-rays* (some scientists place the lower limit at higher values, up to 40 nanometers). Also known as ultraviolet light.

**uncanistered spent nuclear fuel**

Fuel placed directly into storage containers or shipping casks without first being placed in a canister.

**uncertainty**

A measure of how much a calculated or estimated value that is used as a reasonable guess or prediction might vary from the unknown true value.

**unsaturated zone**

The area between the surface and the *water table* where only some of the spaces (*fractures* and rock pores) are filled with water. See *saturation zone*.

vadose zone

See *unsaturated zone*.

Viability Assessment

An assessment of the prospects for geologic disposal at the Yucca Mountain site, based on repository and *waste package* design, a *Total System Performance Assessment*, a *License Application* plan, and repository cost and schedule estimates. DOE issued the *Viability Assessment of a Repository at Yucca Mountain* in December 1998.

vicinity (in relation to the Yucca Mountain Repository)

A general term used in nonspecific discussions in this EIS about the area around the Yucca Mountain site.

vitrification

A waste treatment process that uses glass (for example, *borosilicate glass*) to encapsulate or immobilize *radioactive* wastes.

waste form

A generic term that refers to *radioactive* waste materials and any encapsulating or stabilizing matrix.

waste package

The *waste form* and any containers (that is, *disposal container* barriers and other canisters), spacing structure or baskets, *shielding* integral to the container, packing inside the container, and other absorbent materials immediately surrounding an individual waste container placed internally to the container or attached to the outer surface of the disposal container. The waste package begins its existence when the outer lid welds are complete and accepted.

water table

The upper limit of the *saturated zone* (the portion of the ground wholly saturated with water).

welded tuff

A *tuff* deposited under conditions where the particles making up the rock were heated sufficiently to cohere. In contrast to nonwelded tuff, welded tuff is denser, less porous, and more likely to be fractured (which increases *permeability*).

wet storage

Storage of *radioactive* material that uses water for cooling or *shielding*.

X-rays

Penetrating electromagnetic *radiation* having a wavelength much shorter than that of visible light. X-rays are identical to *gamma rays* but originate outside the *nucleus*, either when the inner orbital *electrons* of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

Yucca Mountain Repository EIS

See *environmental impact statement (EIS)*.

Yucca Mountain site (the site):

The area on which DOE has built or would build the majority of facilities or cause the majority of land disturbances related to the proposed repository.

zeolite

Any of a group of hydrated silicates of aluminum with alkali metals, commonly occurring as secondary minerals in cavities in basic volcanic rocks.

zirconium alloy

An alloy material containing the element zirconium that might have any of several compositions. It is used as a *cladding* material.